

June 14, 1995

Mr. J. H. Goldberg  
President - Nuclear Division  
Florida Power and Light Company  
P.O. Box 14000  
Juno Beach, Florida 33408-0420

Dear Mr. Goldberg:

SUBJECT: ST. LUCIE UNIT 2 - ISSUANCE OF AMENDMENTS RE: REDUCTION IN  
REQUIRED MINIMUM SHUTDOWN COOLING FLOW RATE (TAC NO. M91695)

The Commission has issued the enclosed Amendment No. 76 to Facility Operating License No. NPF-16 for the St. Lucie Plant, Unit No. 2. This amendment consists of changes to the Technical Specifications in response to your application dated February 27, 1995.

This amendment will modify surveillance requirement (SR) 4.9.8.1 and 4.9.8.2 to allow a reduction in the required minimum shutdown cooling flow rate under certain conditions during operational MODE 6. In addition, the format of the SR will be changed to clarify the intent of the stated surveillances.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

Original signed by:

Jan A. Norris, Senior Project Manager  
Project Directorate II-1  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

Docket No. 50-389

Enclosures:

1. Amendment No. 76 to NPF-16
2. Safety Evaluation

cc w/enclosures:

See next page

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Florida Power and Light Company

St. Lucie Plant

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DATED: June 14, 1995

AMENDMENT NO. 76 TO FACILITY OPERATING LICENSE NO. NPF-16 - ST. LUCIE, UNIT 2

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

FLORIDA POWER & LIGHT COMPANY

ORLANDO UTILITIES COMMISSION OF

THE CITY OF ORLANDO, FLORIDA

AND

FLORIDA MUNICIPAL POWER AGENCY

DOCKET NO. 50-389

ST. LUCIE PLANT UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 76  
License No. NPF-16

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Florida Power & Light Company, et al. (the licensee), dated February 27, 1995, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

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2. Accordingly, Facility Operating License No. NPF-16 is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and by amending paragraph 2.C.2 to read as follows:

2. Technical Specifications

- The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 76, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION



David B. Matthews, Director  
Project Directorate II-1  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: June 14, 1995

ATTACHMENT TO LICENSE AMENDMENT NO. 76

TO FACILITY OPERATING LICENSE NO. NPF-16

DOCKET NO. 50-389

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by amendment number and contain vertical lines indicating the area of change. The corresponding overleaf pages are also provided to maintain document completeness.

Remove Pages

3/4 9-8

3/4 9-9

B 3/4 9-2

Insert Pages

3/4 9-8

3/4 9-9

B 3/4 9-2

## REFUELING OPERATIONS

### 3/4.9.7 CRANE TRAVEL - SPENT FUEL STORAGE POOL BUILDING

#### LIMITING CONDITION FOR OPERATION

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3.9.7 Loads in excess of 1600 pounds shall be prohibited from travel over fuel assemblies in the spent fuel storage pool.

APPLICABILITY: With fuel assemblies in the spent fuel storage pool.

#### ACTION:

With the requirements of the above specification not satisfied, place the crane load in a safe condition.

#### SURVEILLANCE REQUIREMENTS

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4.9.7 Crane interlocks and physical stops which prevent crane travel with loads in excess of 1600 pounds over fuel assemblies shall be demonstrated OPERABLE within 7 days prior to crane use and at least once per 7 days thereafter during crane operation.

## REFUELING OPERATIC

### 3/4.9.8 SHUTDOWN COOLING AND COOLANT CIRCULATION

#### HIGH WATER LEVEL

#### LIMITING CONDITION FOR OPERATION

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3.9.8.1 At least one shutdown cooling loop shall be OPERABLE and in operation.\*

**APPLICABILITY:** MODE 6 when the water level above the top of the reactor pressure vessel flange is greater than or equal to 23 feet.

#### **ACTION:**

With no shutdown cooling loop OPERABLE and in operation, suspend all operations involving an increase in the reactor decay heat load or a reduction in boron concentration of the Reactor Coolant System and within 1 hour initiate corrective action to return the required shutdown cooling loop to OPERABLE and operating status as soon as possible. Close all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere within 4 hours.

#### SURVEILLANCE REQUIREMENTS

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4.9.8.1 At least once per 12 hours:

- a. At least one shutdown cooling loop shall be verified to be in operation.
- b. The total flow rate of reactor coolant to the reactor pressure vessel shall be verified to be greater than or equal to 3000 gpm.\*\*

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\* The shutdown cooling loop may be removed from operation for up to 1 hour per 8-hour period during the performance of CORE ALTERATIONS in the vicinity of the reactor pressure vessel hot legs.

\*\* The reactor coolant flow rate requirement may be reduced to 1850 gpm if the following conditions are satisfied before the reduced requirement is implemented: the reactor has been determined to have been subcritical for at least 125 hours, the maximum RCS temperature is  $\leq 117^{\circ}\text{F}$ , and the temperature of CCW to the shutdown cooling heat exchanger is  $\leq 87^{\circ}\text{F}$ .



## REFUELING OPERATIO

### LOW WATER LEVEL

#### LIMITING CONDITION FOR OPERATION

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3.9.8.2 Two independent shutdown cooling loops shall be OPERABLE and at least one shutdown cooling loop shall be in operation.

**APPLICABILITY:** MODE 6 when the water level above the top of the reactor pressure vessel flange is less than 23 feet.

**ACTION:**

- a. With less than the required shutdown cooling loops OPERABLE, within 1 hour initiate corrective action to return the required loops to OPERABLE status, or to establish greater than or equal to 23 feet of water above the reactor pressure vessel flange, as soon as possible.
- b. With no shutdown cooling loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and within 1 hour initiate corrective action to return the required shutdown cooling loop to operation. Close all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere within 4 hours.

#### SURVEILLANCE REQUIREMENTS

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4.9.8.2 At least once per 12 hours:

- a. At least one shutdown cooling loop shall be verified to be in operation.
- b. The total flow rate of reactor coolant to the reactor pressure vessel shall be verified to be greater than or equal to 3000 gpm.\*

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\* The reactor coolant flow rate requirement may be reduced to 1850 gpm if the following conditions are satisfied before the reduced requirement is implemented: the reactor has been determined to have been subcritical for at least 125 hours, the maximum RCS temperature is  $\leq 117$  °F, and the temperature of CCW to the shutdown cooling heat exchanger is  $\leq 87$  °F.

## REFUELING OPERATIONS

### 3/4.9.9 CONTAINMENT ISOLATION SYSTEM

#### LIMITING CONDITION FOR OPERATION

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3.9.9 The containment isolation system shall be OPERABLE.

APPLICABILITY: During CORE ALTERATIONS or movement of irradiated fuel within the containment.

ACTION:

With the containment isolation system inoperable, close each of the containment penetrations providing direct access from the containment atmosphere to the outside atmosphere. The provisions of Specification 3.0.4 are not applicable.

#### SURVEILLANCE REQUIREMENTS

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4.9.9 The containment isolation system shall be demonstrated OPERABLE within 72 hours prior to the start of and at least once per 7 days during CORE ALTERATIONS by verifying that containment isolation occurs on manual initiation and on a high radiation test signal from each of the containment radiation monitoring instrumentation channels.

## 3/4.9 REFUELING OPERATIONS

### BASES

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#### 3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: (1) the reactor will remain subcritical during CORE ALTERATIONS, and (2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the safety analyses. The value of 0.95 or less for  $K_{eff}$  includes a 1% delta k/k conservative allowance for uncertainties. Similarly, the boron concentration value of 1720 ppm or greater also includes a conservative uncertainty allowance of 50 ppm boron.

#### 3/4.9.2 INSTRUMENTATION

The OPERABILITY of the startup neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

#### 3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the safety analyses.

#### 3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

The requirements on containment penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE.

#### 3/4.9.5 COMMUNICATIONS

The requirement for communications capability ensures that refueling station personnel can be promptly informed of significant changes in the facility status or core reactivity condition during CORE ALTERATIONS.

**3/4.9.6 MANIPULATOR CRANE**

The OPERABILITY requirements for the refueling machine ensure that: (1) manipulator cranes will be used for movement of fuel assemblies, with or without CEAs, (2) each crane has sufficient load capacity to lift a fuel assembly, with or without CEAs, and (3) the core internals and pressure vessel are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

**3/4.9.7 CRANE TRAVEL - SPENT FUEL STORAGE POOL BUILDING**

The restriction on movement of loads in excess of the nominal weight of a fuel assembly, CEA and associated handling tool over other fuel assemblies in the storage pool ensures that in the event this load is dropped (1) the activity release will be limited to that contained in a single fuel assembly, and (2) any possible distortion of fuel in the storage racks will not result in a critical array. This assumption is consistent with the activity release assumed in the safety analyses.

**3/4.9.8 SHUTDOWN COOLING AND COOLANT CIRCULATION**

The requirement that at least one shutdown cooling loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F as required during the REFUELING MODE, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effects of a boron dilution incident and prevent boron stratification.

The requirement to have two shutdown cooling loops OPERABLE when there is less than 23 feet of water above the reactor pressure vessel flange with irradiated fuel in the core ensures that a single failure of the operating shutdown cooling loop will not result in a complete loss of decay heat removal capability. With the reactor vessel head removed and 23 feet of water above the reactor pressure vessel flange with irradiated fuel in the core, a large heat sink is available for core cooling, thus in the event of a failure of the operating shutdown cooling loop, adequate time is provided to initiate emergency procedures to cool the core.

The footnote providing for a minimum reactor coolant flow rate of  $\geq 1850$  gpm considers one of the two RCS injection points for a SDCS train to be isolated. The specified parameters include 50 gpm for flow measurement uncertainty, and 3°F uncertainty for RCS and CCW temperature measurements. The conditions of minimum shutdown time, maximum RCS temperature, and maximum temperature of CCW to the shutdown cooling heat exchanger are initial conditions specified to assure that a reduction in flow rate from 3000 gpm to 1800 gpm will not result in a temperature transient exceeding 140°F during conditions when the RCS water level is at an elevation  $\geq 29.5$  feet.

**3/4.9.9 CONTAINMENT ISOLATION SYSTEM**

The OPERABILITY of this system ensures that the containment isolation valves will be automatically isolated upon detection of high radiation levels within the containment. The OPERABILITY of this system is required to restrict the release of radioactive material from the containment atmosphere to the environment.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 76

TO FACILITY OPERATING LICENSE NO. NPF-16

FLORIDA POWER AND LIGHT COMPANY, ET AL.

ST. LUCIE PLANT, UNIT NO. 2

DOCKET NO. 50-389

1.0 INTRODUCTION

By letter dated February 27, 1995, the Florida Power & Light Company (FPL) requested changes to the Technical Specifications (TS) for the St. Lucie Plant, Unit 2. A provision is to be added to the existing TS to allow the 3000 gpm required minimum reactor coolant flow rate via the shutdown cooling system to be reduced, under certain conditions, to 1850 gpm. The revision will accommodate isolation of a Shutdown Cooling System (SDCS) from Reactor Coolant System (RCS) injection line for maintenance during MODE 6 (refueling) conditions. The analysis of the revision considers single failure criteria.

The statement of required surveillance will be revised to clarify that the specified reactor coolant flow rate is the total flow rate to the reactor pressure vessel. The changes are described below:

- 1) Surveillance Requirements (SR) 4.9.8.1 and 4.9.8.2 specify that, "At least one shutdown cooling loop shall be verified to be in operation and circulating reactor coolant at a flow rate of greater than or equal to 3000 gpm at least once per 12 hours." The surveillance requirement will be modified as follows:

"At least once per 12 hours:

- a. At least one shutdown cooling loop shall be verified to be in operation.
- b. The total flow rate of reactor coolant to the reactor pressure vessel shall be verified to be greater than or equal to 3000 gpm."

- 2) The specified minimum flow rate specified in SR 4.9.8.1 and 4.9.8.2 will be modified by adding the following footnote:

"The reactor coolant flow rate requirement may be reduced to 1850 gpm if the following conditions are satisfied before the reduced requirement is implemented: the reactor has been determined to have been subcritical for at least 125 hours, the maximum RCS temperature is  $\leq 117$  °F, and the temperature of CCW to the shutdown cooling heat exchanger is  $\leq 87$  °F."

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- 3) Bases section B 3/4.9.8 will be revised by adding a summary statement of the reasons for the specific plant conditions under which the footnote may be applied. The summary statement is as follows: "The footnote providing for a minimum reactor coolant flow rate of  $\geq 1850$  gpm considers one of the two RCS injection points for a SDCS train to be isolated. The specified parameters include 50 gpm for flow measurement uncertainty, and 3 °F uncertainty for RCS and CCW temperature measurements. The conditions of minimum shutdown time, maximum RCS temperature, and maximum temperature of CCW to the shutdown cooling heat exchanger are initial conditions specified to assure that a reduction in flow rate from 3000 gpm to 1800 gpm will not result in a temperature transient exceeding 140 °F during conditions when the RCS water level is at an elevation  $\geq 29.5$  feet."

## 2.0 BACKGROUND

The plant design provides two independent SDCS loops, each with a Low Pressure Safety Injection (LPSI) pump and two injection lines. During MODE 6 operation, an OPERABLE shutdown cooling loop must be capable of circulating reactor coolant at a flow rate  $\geq 3000$  gpm to satisfy the specified surveillances. To support certain maintenance activities on the low pressure safety injection headers, which are the same headers used to circulate reactor coolant during SDCS operation, one of the two RCS injection lines for the affected train must be isolated.

With the water level less than 23 feet above the top of the reactor pressure vessel flange, two independent shutdown cooling loops must be OPERABLE pursuant to the limiting condition of operation (LCO) 3/4.9.8.2, and the 3000 gpm minimum flow capacity be maintained to satisfy the SR. The SDCS pump flow through a single injection line header path can provide a flow rate of approximately 2000 gpm. Since this single RCS injection point in the SDCS train is incapable of achieving  $\geq 3000$  gpm, this train must be declared inoperable. Therefore, maintenance that requires isolation of one of the two injection flowpaths for either SDCS train is prohibited, and is limited to the plant condition where only one OPERABLE shutdown cooling loop is required e.g., the RCS water level is greater than 23 feet above the reactor pressure flange (TS 3/4.9.8.1). For this reason, analyses were performed by the licensee to verify the adequacy of one SDCS train to satisfy the Bases for the existing LCO when the flow rate capacity of that train is limited to less than 3000 gpm.

## 3.0 EVALUATION

The licensee addressed the MODE 6 operability requirements for shutdown cooling loops as described in Basis Section 3/4.9.8 which states:

- (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140 °F as required in the REFUELING MODE, and

- (2) sufficient coolant circulation is maintained through the reactor core to minimize the effects of a boron dilution incident and prevent boron stratification.

In addition, the requirement to have two shutdown cooling loops OPERABLE when there is less than 23 feet of water above the reactor pressure vessel flange with irradiated fuel in the core ensures that a single failure of the operating shutdown cooling loop will not result in a complete loss of decay heat removal capability.

An evaluation was performed by the licensee to show the ability to satisfy the above bases for TS 3/4.9.8. This considered a MODE 6 plant configuration where the water level is less than 23 feet above the reactor pressure vessel flange, the alternate SDCS train is inoperable, and the operating shutdown cooling loop is circulating reactor coolant through only one SDCS-to-RCS cold leg penetration. The licensee stated that the specified conditions for which the reduced flow rate will be permitted are considered to be conservative, and are compatible with the existing bases for the affected LCO. The calculations were performed by Ouzo Brown Boveri-Combustion Engineering (ABB-CE) and were confirmed by FPL. The principal assumptions were as follows:

- a. Initial maximum RCS temperature 120 °F.
- b. Initial component cooling water (CCW) temperature 90 °F.
- c. Decay heat fractions per NRC Branch Technical Position (BTP) ASB 9-2 (Standard Review Plan 9.2.5).
- d. Shutdown cooling system (SDCS) Injection Flow 1800 gpm (Minimum Guaranteed).
- e. RCS Level 29.5 feet (This is 4 feet below the reactor pressure vessel flange and corresponds to RCS Mid-Loop operation).

The licensee made analyses for the effects of the reduction in flow rate for shutdown cooling which addressed: (1) decay heat removal, (2) boron dilution, (3) boron stratification, and (4) guaranteed minimum flow. The results are discussed below.

### 3.1 Decay Heat Removal

The analysis of the decay heat removal was performed to determine whether sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140 °F as required in the Mode 6 refueling mode.

The analysis was based on a RCS flow rate of 1800 gpm, and a reduced coolant inventory corresponding to an RCS water level of 29.5 feet (mid-loop). The primary system masses and volumes were conservatively calculated assuming that the steam generator nozzle dams are installed. The decay heat fraction was taken from the NRC BTP ASB 9-2 formulation. This analysis was based on an operating history of 16000 effective full power operating hours (EFPH).

Based on these inputs, the resultant peak RCS temperature was shown to be less than 140 °F and therefore acceptable when the time after shutdown is at least 5 days (120 hrs).

FPL further determined that the proposed minimum shutdown time of 125 hours would provide additional conservatism and extend applicability of the analysis to a 24-month fuel cycle (assumed 16500 EFPH).

### 3.2 Boron Dilution

The analysis for boron dilution was to determine whether sufficient coolant circulation is maintained through the reactor core to minimize the effects of a boron dilution incident.

Calculations performed by the licensee show that at a flow rate of 1800 gpm and coolant inventory corresponding to mid-loop operation, a transit time of 17 minutes is required for one cycle of RCS fluid circulation.

The Updated Final Safety Analysis Report (UFSAR) documents the Inadvertent Boron Dilution event for MODE 6 conditions. The UFSAR analysis shows that, for the assumed condition of three charging pumps running, a boron dilution alarm would be required at no less than 58 minutes, and the minimum time to criticality would be more than 88 minutes. These times correspond to more than 3 and 5 times the shutdown cooling loop transit time (17 minutes), respectively.

Therefore, the flow rate of 1800 gpm is considered adequate to provide sufficient mixing and a timely indication of a gradual, uniform decrease in RCS boron concentration. Also, it is concluded that the reactor operator has sufficient time to recognize the event and isolate the dilution source prior to significant loss of shutdown margin.

### 3.3 Boron Stratification

The results of an analysis for boron dilution have indicated that sufficient coolant circulation is maintained through the reactor core to prevent boron stratification.

The licensee stated that, for the range of temperatures under consideration, boron precipitation is considered to be unlikely unless a very highly concentrated boron source (much greater than 3.5 weight percent boric acid) inserts large amounts of boron into the RCS. LCO 3.1.2.7 limits the maximum concentration in the boric acid makeup tanks to 3.5 wt. % (6119 ppm boron); thus, assurance is provided that boron in the RCS will not achieve concentration at which precipitation would occur. Boron precipitation caused by dilution with cold water is also not expected to occur for the boron concentrations required during MODE 6 refueling operations.



The licensee stated that, assuming the RCS is well mixed prior to entering the reduced flow configuration, stratification is not considered credible at the proposed flow rate without the occurrence of boron precipitation. Diffusion in a stagnant region is the only other mechanism for stratification and, based on an assessment of the diffusion coefficients, would require more than four months to develop (well beyond the time scale of interest).

Based on the above, it is concluded that boron stratification would not occur for the conditions assumed in this analysis.

### 3.4 Guaranteed Minimum Flow

The minimum flow rate assumed in the analysis was 1800 gpm. The flow rate corresponding to one LPSI pump injecting reactor coolant into the RCS through one line of maximum resistance is calculated by the licensee to be approximately 2000 gpm. Therefore, since this value is greater than 1800 gpm, there is assurance that a single point injection will satisfy the value of flow rate assumed in the analysis.

### 4.0 TECHNICAL FINDINGS

The staff has reviewed the licensee's analyses and agrees with the licensee's evaluations. Therefore, the staff concludes that the licensee's proposed revision to the Technical Specifications for the St. Lucie Plant, Unit 2, to allow a reduction in the required minimum shutdown cooling flow rate under certain conditions during operation in MODE 6 is acceptable.

### 5.0 STATE CONSULTATION

Based upon the written notice of the proposed amendment, the Florida State official had no comments.

### 6.0 ENVIRONMENTAL CONSIDERATION

This amendment changes only surveillance requirements. The NRC staff has determined that the amendment involves no increase in the amounts, and no change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (60 FR 16187). Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: H. Balukjian

Date: June 14, 1995